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Degenerate Sobolev and Poincare Inequalities via Extrapolation

In this talk I will describe recent results with F. Dal (YTU IST, Turkiye) and D. Cruz-Uribe (UAl). For a possibly degenerate symmetric non-negative semidefinite matrix valued function Q(x) on a bounded domain Ω of $\mathbb{R}^n$ that satisfies varying versions of the ellipticity condition

$$w(x)|\xi|^p \leq |\sqrt{Q(x)}\xi|^p \leq v(x)|\xi|^p$$

for a $p \in (1, \infty)$ and weights w, v, we show that a Sobolev inequality of the form

$$\|f\|_{L^{p\tau}(v,\Omega)} \leq C\|w^{-1}\|_{L^s(\Omega)}\|v\|_{L^r(\Omega)}\|\sqrt{Q}\nabla f\|_{L^p(\Omega)}$$

holds for constants $C, 1 \leq r, s \leq \infty$ and $\tau \geq 1$ independent of $f \in Lip_c(\Omega)$. Our techniques do not require any doubling conditions on the weights nor do they ask for Mukenhoupt A_p conditions. Our techniques rely on ideas from the theory of Rubio De Francia extrapolation in harmonic analysis.